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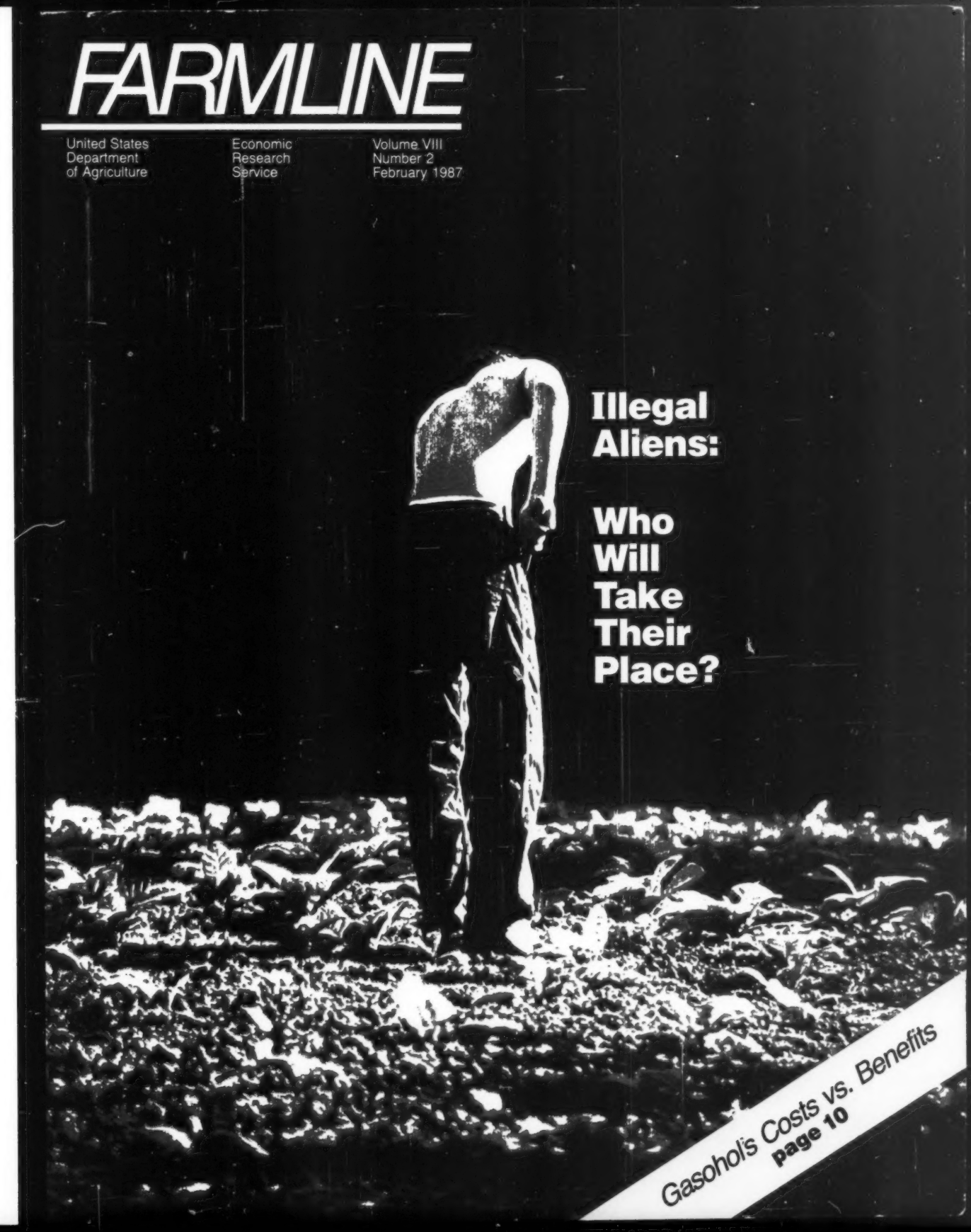

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TAKE PRIDE IN AMERICA

FARMLINE

AGRICULTURE . . . NATURAL RESOURCES . . . RURAL DEVELOPMENT
Practical economic intelligence from USDA's Economic Research Service

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For many producers of perishable commodities, the nation's new immigration law may pose a dual threat—a clampdown on illegal aliens who provide low-cost farm labor, and penalties on those who hire them. But there are other provisions, too. The law opens the doors to legal residency and employment for large numbers of undocumented farmworkers, and it also offers ways to bring in foreign workers to meet agriculture's future labor needs.

Helping Ourselves by Helping Farmers Abroad *by Gary Vocke* 6

Why should the United States help farmers in less developed countries become more productive? The answer, according to economist Gary Vocke, centers on the relationship between farm incomes and imports in these nations. And what's at stake is not only Third World economic development, but the long-term growth of the foreign markets on which U.S. agriculture is so dependent. In this article, he explains why.

Why Gasohol Can't Pass the Farm Income Cost-Benefit Test *by Doug Martinez* 10

Boosting farm income by subsidizing fuel ethanol (gasohol) from grain is making less and less economic sense as energy prices remain depressed. That's the gist of a recent assessment weighing the net gains in farm income from fuel ethanol production against the costs to consumers and taxpayers. Given the ethanol industry's prospects for continued dependence on government subsidies, it would be more economical, says this analysis, to pay the subsidies directly to farmers.

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This is your tear-it-out and post-it-up guide to winter-spring release dates for situation and outlook reports of the Economic Research Service, crop and livestock reports of the National Agricultural Statistics Service, and supply-demand estimates of the World Agricultural Outlook Board.

Immigration Reform: Who Will Harvest America's Produce?

Thousands of foreign workers who help in the harvest of America's agricultural bounty may be doing their jobs a little differently in the future.

If all goes as planned, they'll be doing them legally—or they won't be doing them at all.

The new immigration law, passed last November, is a broad attempt to gain control over the nation's borders. It imposes strict requirements on foreign workers and their U.S. employers.

"To encourage compliance with the law, employers who knowingly hire illegal aliens will eventually face fines, and those employers who persist in hiring illegals may be sentenced to prison," says economist Robert Coltrane of USDA's Economic Research Service.

At the same time, however, the law addresses the interests of workers and employers. Its provisions open the doors to legal residency for many aliens who have been living and working here illegally. It is also designed to provide for the labor needs of industries, especially agriculture, that are heavily dependent on foreign workers.

For foreign agricultural workers who would not qualify under its general amnesty provisions (because they could not prove continuous residency in the United States since before January 1, 1982), the law provides at least three major pathways to working legally in this country.

Some alien farmworkers can qualify for temporary—and ultimately permanent—residency status under a special agricultural worker program. This program applies to those with a work history in fruits, vegetables, and other "perishable commodities" to be defined by the Secretary of Agriculture.

Others may be allowed to enter the country between 1989 and 1993 and gain residency if there's a shortage of workers at that time in the designated perishable commodities.

Still others can be brought in as temporary workers to perform specific, limited-duration jobs for specific farm employers. When their contract period ends, they have to return to their native countries.

Each path has its own particular requirements, but two of the three are tied to employment in the production of labor-intensive perishable commodities.

A Pathway to Residency

"Illegal aliens who have previously worked on farms producing perishable commodities may qualify for temporary legal status," says Coltrane.

Since no one knows how many illegal aliens are employed in agriculture, precise estimates cannot be made of the number who may eventually apply for legal status under the special agricultural worker program. By the bill's reckoning, though, as many as 350,000 foreign workers could come under one category of legalization.

This first group (capped at 350,000) includes illegal aliens who have worked in the production of the designated perishable commodities for at least 90 "man-days" in each of the last 3 years—1984, 1985, and 1986—ending May 1. (The term "man-days" as applied to the eligibility requirements was not defined in the law, but will be specified by the U.S. Immigration and Naturalization Service in administrative regulations outlining how this program will operate.)

"The law does specify that workers in this group would become permanent residents 1 year after they receive this temporary resident status," adds Coltrane.

A second group, for which there is no numerical limit, must have worked only 90 "man-days" in perishable commodities in the year ending May 1, 1986, to qualify for temporary legal status. However, these workers must wait 2 years before obtaining permanent resident status.

Both groups of foreign workers may apply for temporary resident status under the law during an 18-month period beginning in early May 1987, 6 months after the law's enactment.

"Although there is no requirement that these workers stay in agriculture after they receive temporary resident status, it is assumed that many of them will continue to do so, at least for a few years," says Coltrane.

Illegal aliens prove particularly important each year in the harvest of perishable commodities—fruits, vegetables, and other horticultural crops.

The Replenishment Path

But the law takes note of the possibility that some of the newly legalized workers will move on to other occupations in the United States.

"In case some quit working in perishable commodities, a portion of those who leave may be replaced by new aliens starting in fiscal year 1990," says Coltrane.

These new workers would immediately receive temporary resident status, but they would be required to work in the production of perishable commodities for a minimum of 90 "man-days" (here defined as 4-hour workdays) per year in each of the first 3 years in order to keep from being deported, he says. "If they complete this requirement, they become permanent residents. And if they work in the designated commodities for 2 additional years (for a total of 5 years), they are eligible to apply for U.S. citizenship."

The "replenishment" program ends in fiscal year 1993. After that, growers of perishable commodities will have to employ domestic farmworkers—or tap into another worker pool established by the new immigration

statute—the H-2A temporary worker program.

The H-2A program allows foreign farmworkers to come into the country for specific jobs and a specific time period.

"Under the Immigration Reform and Control Act of 1986, agricultural employers may hire foreign workers on a temporary basis when qualified domestic workers are not available to do the work at the time and place needed," says Coltrane. "Before an employer can recruit and hire a foreign worker, the U.S. Department of Labor must certify that such employment will not adversely affect the wages and working conditions of U.S. workers similarly employed."

Provision for Temporary Workers

The H-2A program is a revision of the H-2 program for agriculture. The new program will likely expand the number of foreign "contract workers" permitted to enter the United States to work in agriculture. All agricultural employers, not just producers of perishable commodities, are eligible to apply for foreign workers under this program.

"This initiative should make it easier for employers to apply for foreign workers on a temporary basis, because some unresolved issues regarding filing dates are clarified in the legislation," Coltrane explains. "However, major issues remain which must be resolved in federal regulations still to be written—methods for setting wage rates, recruitment procedures employers must follow, and housing standards for workers."

H-2A workers will not qualify for temporary or permanent resident status. They will simply work for the time specified in their contracts and return home. While they will not qualify for such benefits as social security and unemployment insurance, the statute and administrative regulations will guarantee certain protections on wages and working conditions.

But protections will be much broader for the workers who receive temporary legal status because they have previously worked in perishable commodities, as well as for "replenishment" workers who come later. They will be covered by the same labor market programs that protect other workers in the United States—minimum wage, social security, and unemployment insurance.

Any employer who knowingly hires an alien not permitted to work in the United States is faced with fines of up to $10,000 and imprisonment for such violations.

According to the immigration act's authors, Coltrane says, the agricultural labor provisions were drawn to provide some equity to illegal workers who had previously worked here—and to allow additional temporary workers under the H-2A program when there are not sufficient U.S. workers to do needed agricultural work. Above and beyond all that, the act is intended to stem the flow of illegal aliens into this country by shutting down the job opportunities that lure them in the first place.

Employers Beware

Coltrane says stiff sanctions against farm employers who violate the new immigration law should deter most employers from hiring illegal aliens.

"Any employer who knowingly hires an alien not permitted to work in the United States is faced with fines of up to $10,000 for each unauthorized alien employed and possible imprisonment for 6 months," he says. "Employers must attest on a form provided by the U.S. Attorney General that they checked proper documents which show that each employee hired is authorized to work in the United States."

These provisions extend, of course, to all American businesses. Farmers and factory owners alike, though, will have 6 months from the time that the President signed the bill into law—November 6, 1986—to adjust to the new demands placed upon them. The federal government will first conduct a 6-month public education campaign to alert employers to their added responsibilities—and the consequences of failing to follow them. For 12 months after that, employers who violate the law will only receive warnings for first offenses. But repeat offenders may be fined during the 12-month period.

Enforcement policies as well as the broader concerns of agricultural employers and workers are among a number of major labor issues that will be studied by a Commission on Agricultural Workers created by the new law. "This commission will include members who can address labor issues from both the industry's and workers' points of view," says Coltrane. It will have 12 members and a support staff, and it must report its findings and recommendations to Congress within 5 years. Members will be appointed by the President and the Congress.

Coltrane says the commission's job is an important one because the immigration reform act has significant and potentially long-term implications for American agriculture.

Certainly, agriculture has only been one of many industries to which undocumented workers have flocked. But the degree of agricultural employers' dependence on illegal workers—particularly in producing and harvesting fruits, vegetables, and other horticultural crops—is probably greater than that of most nonagricultural businesses.

Moreover, says Coltrane, "the sanctions against employers of illegal aliens, the H-2A program for agriculture, the special agricultural worker program for perishable commodities, and the general legalization program for illegal aliens can each affect the supply and cost of labor available for employment in agriculture."

He adds that "while it is clear illegal aliens have comprised a significant part of the total seasonal workforce in agriculture in the past 20 years, the lack of good estimates of their numbers and the amount of labor they have supplied prevents anyone from making precise estimates of the impact that these new programs will have on the industry at this time." □

[*Based primarily on information provided by economist Robert Coltrane of the Agriculture and Rural Economics Division, Economic Research Service.*]

A History of Dependence on Foreign Labor

Illegal aliens working in U.S. agriculture are part of a migrant stream that branches northward as fruits, vegetables, and other crops ripen.

If seen superimposed on a map of the United States, the stream would stretch from California and Texas to Florida, and upwards to the Pacific Northwest, Great Lakes, New York, New Jersey, and New England.

Each year, 2½ to 3 million hired farmworkers, many of them illegal aliens, work on U.S. farms. Some of these workers are full-time employees, but many normally work at harvest jobs lasting anywhere from a few days to a few months.

Illegal workers have been crucial to the commercial fruit and vegetable farms that specialize in commodities which must be hand-harvested—or whose cultivation is labor-intensive. In congressional testimony, a number of experts have estimated that more than half of the migrants working in agriculture in the western states are illegal aliens.

Some of the crops involved, such as lettuce, broccoli, and strawberries, are almost exclusively picked by hand. Others rely on machine as well as man for harvest—tomatoes, cherries, and grapes, for example. Still others, such as white potatoes, carrots, and cranberries, are harvested mechanically.

There are at least two major reasons for the continuing reliance on hand-harvesting for some commodities. The most obvious is the quality and cosmetic value of hand-picked fruits and vegetables, which are later carefully selected by consumers.

The other major reason, which has held true in parts of this country for at least a hundred years, is the ready supply of foreign, and often illegal, workers.

Large produce farms now common to many parts of our country first emerged in California in the 1880's, developing the pattern of seasonal farm labor that continues today.

The Chinese laborers who helped build the transcontinental railroad that opened eastern markets for western produce later became migrant farmworkers, traveling from farm to farm to harvest fruits and vegetables.

But many of these former railroad workers drifted out of agricultural jobs, and the Chinese Exclusion Acts enacted by Congress blocked the entry of replacement Chinese workers.

However, other groups soon came to replace them in agriculture: the Japanese until the 1906 Gentlemen's Agreement halted their immigration, then Filipinos, Mexicans during and after World War I, the displaced dust bowl farmers in the 1930's, and Mexicans since.

Mexican workers, in fact, have been the largest continuing source of migrant farm labor—and not surprisingly. Mexico shares a 2,000-mile border with the United States, and economic need has prompted many Mexicans to join the U.S. seasonal farm workforce.

More than 40 years ago, the U.S. government took its first steps to regulate the flow from Mexico. Beginning in 1942, the U.S. government helped recruit and bring Mexican workers into the United States to work as migrant laborers in the face of labor shortages caused by World War II. By mid-1951, Congress had enacted legislation later known as the "bracero" program to guarantee American farmers a stable supply of willing Mexican workers.

Although scheduled to end after 1953, the "bracero" program was extended for 11 years. At its peak from 1956-59, more than 425,000 Mexican citizens were admitted annually to work in American agriculture.

When it expired in 1964, the bracero program was replaced with a little-used feature of a 1952 immigration law package. A section of this legislation—the H-2 provision—permitted the entry of foreign workers for farmwork when domestic workers could not be found.

But H-2 never matched the numbers of "bracero" workers who came into the United States, largely because of administrative difficulties faced by farmers who tried to use the program. Only about 20,000 H-2 agricultural workers were admitted to the United States each year.

Less difficulty has been encountered by farmers in hiring illegal aliens. According to economist Robert Coltrane, undocumented workers typically work for the same set of farmers each year. And when these workers leave agricultural work in the United States, he says, they often pass the word along an informal "grapevine," telling other illegal aliens of possible work to be found with their previous employers.

"Many of the nation's commercial fruit and vegetable farmers have found a substantial and enduring workforce in illegal aliens," says Coltrane. "Farmers will be watching carefully to see whether this workforce can be fully and flexibly replaced by legal workers under the new immigration reforms."

Helping Ourselves by Helping Farmers Abroad

U.S. assistance to promote economic growth and development in the world's poorer nations can stir up some strong emotions, particularly when the assistance is agricultural. Why, the critics ask, should the United States spend money for agricultural development abroad when budgets are tight and many farmers here at home are struggling? Why assist other nations in producing more food when U.S. farm surpluses are so large and U.S. exports so depressed?

In addressing such questions, economist Gary Vocke of USDA's Economic Research Service draws on research into the broader issues of economic and agricultural development in Third World nations. His perspective is not a philosophical one. He does not cite U.S. foreign policy interests, the benefits of world economic and political stability, the moral obligations of the more affluent nations, or the encouragement of market-based economies and the democratic principles they engender.

Instead, Vocke focuses on the economic self-interest of U.S. agriculture. His conclusion: Agricultural development assistance is a sound investment in the long-term growth of the foreign markets on which U.S. agriculture is so dependent. In the following article, he explains why.

The best strategy to increase the future potential for U.S. agricultural exports is to encourage and promote rising incomes in the less developed countries. These are the growth markets for U.S. farm products, the markets where diets are improving and will continue to improve as incomes improve.

Among the less developed countries (LDC's), the general relationship between income and imports is this: the higher the income, the greater the need for agricultural imports to meet the demand for food. During the 1970's, growth in import markets was more rapid among the LDC's, and especially the LDC's with higher incomes, than among the industrialized or centrally planned nations. Overall, LDC imports of agricultural products grew faster than their exports, even though many of these countries increased the yields and output of their farms.

The fact that gains in LDC farm output coincided with growth in their agricultural imports raises a second point, which may be even more difficult to grasp. For the lower income LDC's—those lingering on or near the bottom rungs of the economic development ladder—the key to raising income, and imports, is a healthier, more productive farm sector.

Much of the U.S. development assistance to these countries is intended to help improve their agricultural productivity through farm technologies geared to their needs. The LDC's are primarily agricultural. Their farm sectors are the largest employers and the major income sources for their populations. If their agricultural sectors are not becoming more productive, incomes are unlikely to rise steadily or rapidly. Stagnant incomes mean stagnant markets.

Higher Ag Incomes, Larger Ag Imports

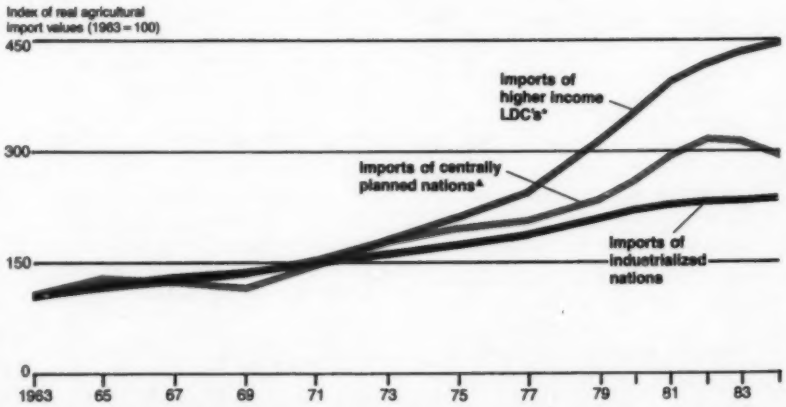
On the other hand, rising productivity fosters higher incomes and increased agricultural imports. First, rising productivity increases the real incomes of farmers and the rural laborers they hire to harvest the additional production. Second, employment and income in urban areas rise because much of the increased farm income is spent on goods and services produced off the farm.

In many cases, increased farm productivity may provide the momentum necessary for moving up the economic development ladder. How? By boosting incomes, creating an excess of rural labor, accelerating the migration to urban areas, and providing the foreign exchange to import both the food and the manufacturing knowhow to feed and employ urban populations.

In this way, new agricultural technologies can initiate broad-based economic progress leading to industrialization, which tends to provide a further stimulus to agricultural imports. Witness the remarkable growth in food imports that has accompanied the industrialization of South Korea and Taiwan.

Again and again, experience has taught us that the development process usually works to the long-term advantage of those who export farm products. Rising incomes transform a latent demand for better diets into real purchasing power. The effective demand for food generally outruns internal

The Higher Income LDC's Provided the Fastest Growing Import Markets of the 1970's



*Includes more than 20 higher income LDC's, such as South Korea, Taiwan, Mexico, Brazil, Saudi Arabia, and Iraq. [4]Includes the Soviet Union, China, Eastern Europe, and a few others.

For the LDC's with economies that depend primarily on agriculture, the key to raising incomes, and imports, is a more productive farm sector.

production because few LDC's have sufficient resources to expand output fast enough to keep up with a rapidly growing economy.

That is why the self-sufficiency of the LDC's in both food grains and feed grains declined during the 1970's. Production was actually rising, but consumption rose even faster, leading to an increasing dependence on imports.

Are there sometimes exceptions to these trends, or tradeoffs for specific export commodities in specific markets? Yes.

A Look at Two "Exceptions"

India is often cited as a wheat market that was lost to U.S. farmers because of new agricultural technologies and increased productivity. In one sense, this is true: The "green revolution" for wheat and rice did reduce India's wheat imports.

However, three points should be made here. First, India is not expected to become a significant competitor in international wheat markets. Second, most of the U.S. exports lost to India's green revolution were subsidized. The exports were a plus for American farmers, but there was a cost paid by U.S. taxpayers.

The final and most important point is this: India still has millions of undernourished people, and the potential demand far exceeds its current production. Given a higher income level, India's present trade position could change drastically.

Brazil is another often-cited example of a developing country where increased agricultural production has had a negative influence on U.S. agricultural exports. From 1970 to 1981, Brazil's agricultural output increased by almost 70 percent, or around 5 percent per year—a rapid rate by international standards.

Although Brazil emerged as a strong competitor in export markets for some commodities, notably soybean meal and oil, the country's aggregate imports of U.S. farm products also increased substantially. In fact, the volume of U.S. agricultural exports to Brazil rose an average of 15 percent per year during the same period. The dollar value climbed 25 percent per year. Moreover, in 1970, 64 percent of U.S. agricultural exports to Brazil were government supported. A decade later, nearly 100 percent of the shipments were commercial transactions.

While increased agricultural production is key to Brazil's dynamic and growing economy, Brazil—like most other LDC's—is not able to expand production in all the commodities necessary to meet the demand unleashed by rapid economic expansion. Thus, growing markets for some U.S. farm products are generated even as improving productivity boosts output of some other crops that are exported by the United States. Brazil illustrates how a growing economy and a rising general income level tend to lead to increased overall imports.

Activating the Latent Demand

Today's concerns about increased agricultural productivity in less developed countries reflect, in part, the sharp decline in U.S. exports and a slowing of consumption and import growth among LDC's.

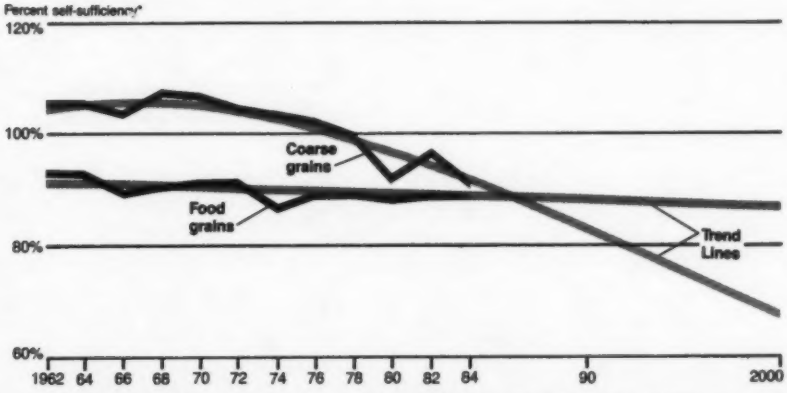
Consumption growth has been stymied because incomes are not climbing as rapidly as they did in the 1970's, and because the severe indebtedness of many LDC's is gobbling up a huge portion of their meager export earnings.

Debt payments and commodity imports compete directly for available foreign earnings. Unless these countries are able to increase their export earnings or obtain additional long-term loans, they must either default on their debts or reduce imports. Many have chosen to reduce their imports.

Since dependence on imported food may be risky for those with a heavy debt burden, countries sometimes try to achieve food self-sufficiency, even if their resources are not well suited for food crops. In addition, many LDC's are subject to International

(continued on page 14)

The Self-Sufficiency of LDC's in Coarse Grains and Food Grains Shows a Declining Trend as Use Outruns Production



*Measures internal production as a percentage of production and net imports combined. Self-sufficiency of 100% means zero net imports.

1987 Reports Calendar

January-June

Titles of Outlook and Situation Reports of the Economic Research Service are printed in color. Summaries of reports are released at 3 p.m. on the dates shown. Copies of complete reports are due off press about a week later. The **World**

JANUARY

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19	20 Catfish FATUS[1]	21	22	23 Cold Storage Cattle on Feed Livestock Slaughter World Food Needs & Availabilities
26	27 Peanut Stocks & Processing Honey	28 Crop Values	29 Eggs, Chickens, & Turkeys Layers & Egg Prod., Annual	30 Agricultural Prices

FEBRUARY

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9 Crop Production Sheep & Goats World Agricultural Supply & Demand	10	11
16	17 Sugar Market Statistics Livestock	18 Agricultural Outlook
23	24	25 Eggs, Chickens, & Turkeys

APRIL

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		1 Egg Products Tobacco	2 Poultry Slaughter Dairy Products Oil Crops	3 Meat Animals, Prod., Disp., & Income Rice
6 Celery	7	8 Land Values Summary	9 Crop Production World Agricultural Supply & Demand	10 Vegetables
13 Turkey Hatchery	14 Potato Stocks Middle East & North Africa	15 Cotton & Wool	16 Floriculture Crops Milk Production World Food Needs & Availabilities	17 Agricultural Outlook
20 Catfish FATUS[1] Dairy	21 East Asia & Oceania	22 Poultry, Production, & Value	23 Eggs, Chickens, & Turkeys	24 Cold Storage Cattle on Feed Livestock Slaughter Feed
27	28 Peanut Stocks & Processing	29	30 Agricultural Prices	

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18 Sugar Market Statistics Wheat	19 Catfish Agricultural Outlook	20 Exports
25	26	27

[1] Foreign Agricultural Trade of the United States.

Agricultural Supply and Demand Estimates *reports, issued by the World Agricultural Outlook Board, are also printed in color. These reports are released to the press in their entirety on the dates shown. To request subscription information on any of these reports, write: EMS Information, Room 228, 1301 New York Ave. N.W., USDA, Washington, D.C. 20005-4788.*

Titles of reports issued by the Agricultural Statistics Board of the National Agricultural Statistics Service (formerly the Statistical Reporting Service) are printed in black. Complete reports are released, most at 3 p.m., on the dates shown. To request subscription information, write: Agricultural Statistics Board, Room 5829 South Bldg., USDA, Washington, D.C. 20250.

MARCH

MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
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16 Cattle on Feed	17 Agricultural Outlook	18 Cold Storage, Annual	19	20 Hop Stocks Catfish Cold Storage Livestock Slaughter World Agriculture
23 Vegetables	24 Eggs, Chickens, & Turkeys Hatchery Production, Annual	25	26	27 Peanut Stocks & Processing Wool & Mohair
30	31 Prospective Plantings; Grain Stocks; Rice Stocks; Agricultural Prices; Hogs & Pigs			

JUNE

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8	9 Crop Production World Agricultural Supply & Demand	10 Vegetables Vegetables, Annual Western Hemisphere	11 Sugar & Sweeteners Yearbook	12 Turkey Hatchery
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Why Gasohol Can't Pass the Farm Income Cost-Benefit Test

Fuel ethanol-gasoline blends, or gasohol, has become an important component of the gasoline market, accounting for more than 7 percent of that market in 1985.

Boosting farm income by subsidizing the production of fuel ethanol from grain is beginning to make less and less economic sense as energy prices remain depressed.

That's the view of researchers at USDA's Office of Energy in a recent report, *Fuel Ethanol and Agriculture: An Economic Assessment.*

"Subsidized ethanol production is a very inefficient way to raise farm income," says USDA economist Gerald Grinnell, one of the researchers. "It would be much more economical to burn straight gasoline in our automobiles and pay farmers a direct subsidy equal to the amount they would receive as a result of ethanol production."

If these conclusions are correct—and not everyone agrees with them—it could mean bad news for the U.S. ethanol industry.

The industry, which was built with the government's financial support, was expected to help protect the United States from the threat of future oil embargoes and spiraling oil prices. Although such threats could arise again in the future, they no longer seem nearly as urgent.

It's that apparent lack of urgency on the energy issue that raises another question: Is continued government support for the industry justified because of ethanol's importance to agriculture?

The Office of Energy study indicates that the ethanol industry cannot survive without massive government subsidies—given the current outlook for petroleum prices. And federal subsidies are scheduled to expire at the end of 1992.

Moreover, even these subsidies (which now amount to 60 cents per gallon of fuel ethanol) are not sufficient for most existing ethanol plants to continue operating, according to Grinnell. "The majority of ethanol producers will need larger subsidies to stay in business, unless oil price increases make fuel ethanol more competitive," he says.

Federal Tax Exemption

Here's how the federal subsidy works: The federal excise tax on gasoline is now 9 cents per gallon. To encourage development of a domestic fuel ethanol industry, the federal government reduced the tax on fuel ethanol-gasoline blends, also known as gasohol.

Gasohol blends of one part ethyl alcohol (ethanol) and nine parts gasoline are eligible for a 6-cents-per-gallon exemption from the federal excise tax. Since 1 gallon of ethanol makes 10 gallons of gasohol after blending with gasoline, that translates into an exemption of 60 cents for each gallon of ethanol.

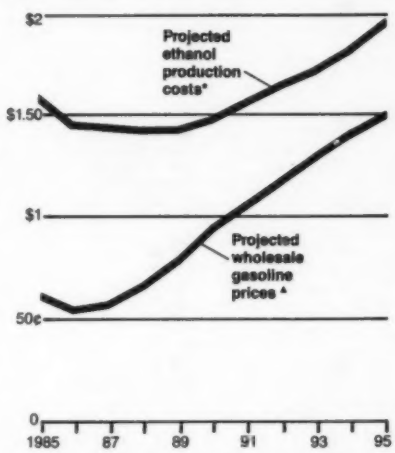
In addition, many states have enacted laws to encourage ethanol production and its use by motorists. More than half of all states offer incentives, usually in the form of exemptions from the state excise tax or sales tax on motor fuels. State subsidies vary, ranging from 10 cents to $1.40 per gallon of ethanol. Some states offer subsidies only for fuel ethanol produced in that state, others for all domestically produced fuel ethanol, and still others for all fuel ethanol, both imported and domestic.

Assisted by such subsidies, the industry produced around 625 million gallons of ethanol in 1985 by converting about 250 million bushels of corn and other feedstocks.

"The fuel ethanol industry grew from near nothing in 1978 to become an important component of the gasoline market," says Grinnell. "The 625 million gallons of fuel ethanol were blended with 5.6 billion gallons of gasoline in 1985."

Since most U.S. ethanol is produced from corn, corn producers have come to view ethanol as a significant market for their crop.

Projections Suggest Ethanol Production Costs Will Continue To Exceed Wholesale Gasoline Prices



*Estimates assume ethanol production grows to 1 billion gallons annually by 1995 and existing federal subsidies are extended or increased. ▲ U.S. Department of Energy "base case" scenario.

"Many people believe that increased ethanol production can help solve the problem of overproduction and low prices in agriculture and reduce the costs of government commodity programs," says Grinnell. "However, the ethanol industry, like agriculture, is heavily dependent on government subsidies. As a result, increased ethanol production could simply shift subsidy payments from agriculture to ethanol interests as more outlays for ethanol subsidies offset lower commodity program costs."

Oil Price Shocks

The fuel ethanol industry grew out of events far from America's Corn Belt. In October 1973, members of OPEC—the Organization of Petroleum Exporting Countries—raised oil prices by 70 percent. And Arab members of OPEC imposed a temporary but complete embargo on crude oil shipments to the United States.

Shock over higher prices and long lines at the gas pump during the 1970's was quickly translated into concern over reliance on

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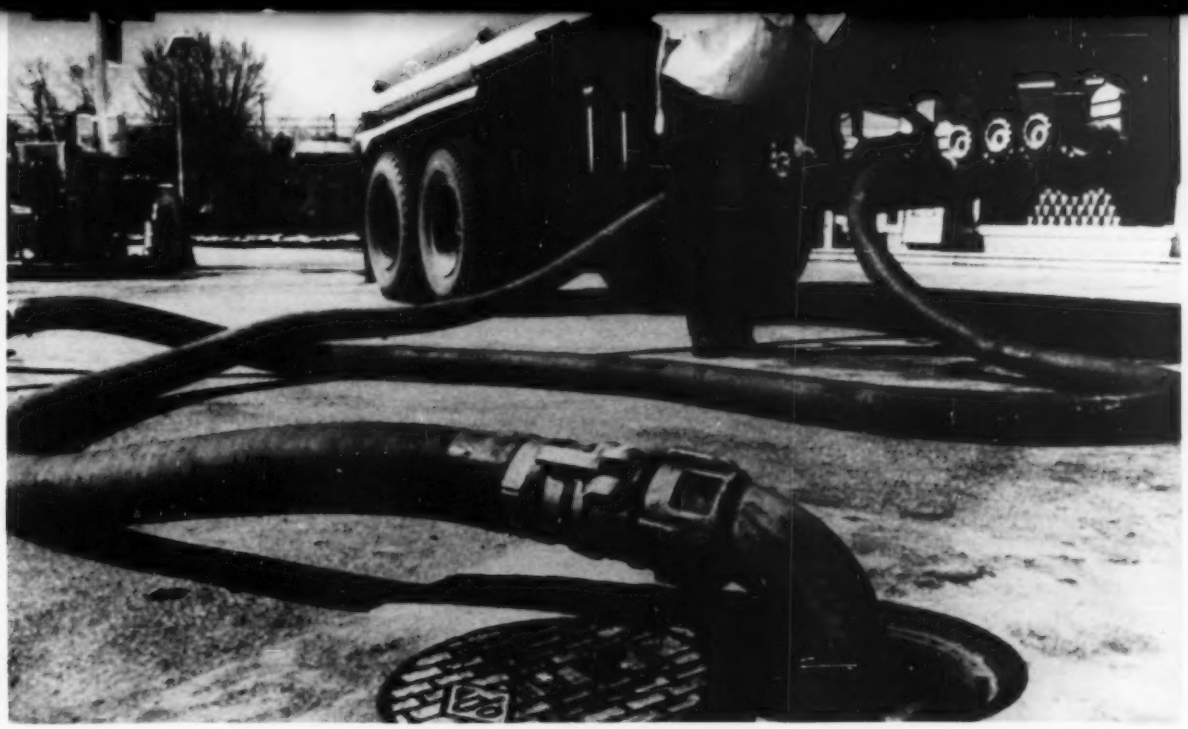
For a copy of the full 54-page report on fuel ethanol, write to USDA's Office of Energy, Rm. 144E, Administration Bldg., Wash., D.C., 20250. Send check or money order for $1.50 to cover postage and handling.



imported oil and into a U.S. government initiative to diversify the sources of energy supplies (including the expansion of domestic energy stocks).

"Ethanol was among the renewable domestic energy sources considered," says Grinnell. Ethanol can be produced from grain, sugar, whey, cellulose, and other materials containing sugar or starch.

Energy planners found several attractive features in ethanol:

- The technology was available. Industrial and beverage ethanol industries had largely perfected the production process. In addition, corn wet-milling facilities could produce either ethanol or high-fructose corn syrup, a sugar substitute.
- Lead time was short. Depending on its size, a fuel ethanol production facility could start up 11 to 26 months after construction began, thereby presenting a relatively swift response to the threat of reduced oil supplies. Other alternate fuels, such as shale oil and gasoline from coal, require far longer periods before economic quantities can be produced.

And, by the early 1980's, it seemed that a bonus had been found: Fuel ethanol production could possibly help make up for declining agricultural exports, by providing a market for the accumulating farm surpluses.

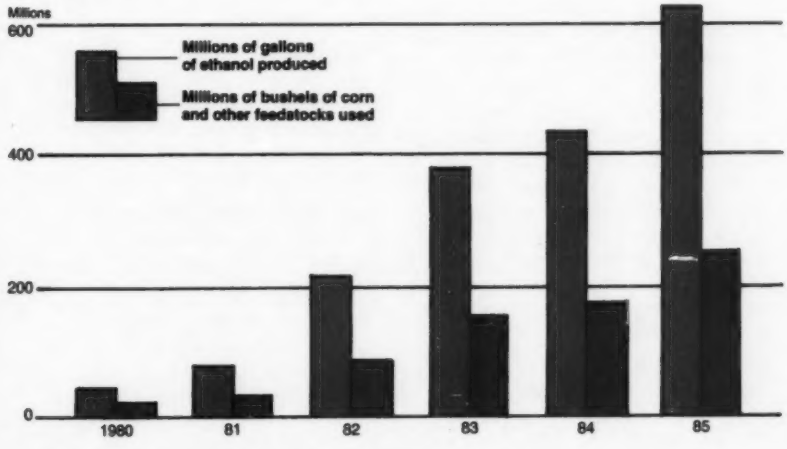
"The effect of ethanol production on farm income is quite clear," says Grinnell. "It raises net farm income. Soybean producers are hurt because the byproducts of additional ethanol production, such as corn gluten feed and meal, displace soybean meal as a livestock feed, but the benefits that accrue to corn producers more than offset these adverse effects."

However, when costs to consumers and taxpayers are included, the balance sheet tells a different story.

"The gains in net farm income must be paid for by large government subsidies to ethanol producers and higher consumer food prices," says Grinnell. "Higher corn prices from additional ethanol-induced demand would increase the cost of producing meat, boosting consumer food expenditures."

Put simply, the conclusion of Grinnell and his colleagues is that the economic costs to

Rapidly Expanding U.S. Ethanol Production Has Provided a Small But Growing Market for Corn



Figures provided by economist Mohinder Gill of USDA's Economic Research Service.

some groups (soybean producers, taxpayers, and consumers) exceed the economic benefits to others (primarily corn producers).

Assessing the Bottom Line

"When all the costs and benefits are tallied," says Grinnell, "an ethanol subsidy program is not cost effective. The costs are so large that ethanol production cannot be justified on economic grounds even if existing producers could get by with present subsidies."

While the increase in net farm income is as high as $2.2 billion under some projections for the 1986-1994 period, overall costs to taxpayers and consumers exceed that figure by several billion dollars.

"If low gasoline prices continue, subsidies alone would exceed the projected cost of gasoline for several years. Lower corn prices have reduced the cost of producing ethanol, but not enough for ethanol to be competitive given anticipated oil prices," he says.

"People generally recognize that our need for renewable energy sources (such as ethanol and solar and wind energy) will increase in the future. However, the present realities of the oil market are forcing recognition that the economic costs of subsidizing production of ethanol and other alternative sources of energy may exceed the measurable economic benefits for years to come."

But Grinnell points out that these conclusions could change if conditions change in the oil market.

"Although it now seems unlikely, a major disruption in oil supplies could increase gasoline prices sharply and reduce the need for ethanol subsidies," Grinnell notes.

Noneconomic issues also need to be addressed when examining government policy toward the ethanol industry. These issues include potential improvements in air quality from greater use of ethanol and the value of reducing our dependence on foreign oil.

Moreover, farmers and others point out that we have a very large surplus of corn and no good uses for it. It seems only logical to many people to convert some of that corn into a useful fuel, even if the economics are not favorable. □

[*Based on material provided by economist Gerald Grinnell and colleagues in USDA's Office of Energy.*]

One of the Benefits—Cleaner Air?

One of the noneconomic issues that seems to weigh in on the favorable side for fuel ethanol (gasohol) comes under the category of a cleaner environment. Automobiles using ethanol-gasoline blends emit less carbon monoxide and some other pollutants than automobiles using straight gasoline.

This fact may mean more sales for fuel ethanol if proposals now being studied in the state of Colorado are adopted—and if other states take similar steps.

A governor's task force there has recommended the required blending of 2 percent or more oxygen content in all gasolines during winter months, when carbon monoxide pollution is particularly bad in Colorado's larger cities. Fuel ethanol is one of several fuels that can be used to oxygenate gasoline. Oxygenated fuels release fewer carbon monoxide and hydrocarbon pollutants into the air because oxygen promotes more complete combustion and reduces an automobile's exhaust emissions.

Colorado suffers from severe carbon monoxide pollution, the worst in the nation.

Moreover, the state needs to make every "reasonable further effort" to reduce this pollution or face the possible loss of federal highway funds, according to the U.S. Environmental Protection Agency (EPA). EPA officials are concerned that Colorado may not be able to comply with rules regarding carbon monoxide control under the federal Clean Air Act.

Of the fuels that would meet the proposed standard, "fuel ethanol is most available now," says Ted Hollman, an air quality expert with the Colorado Department of Health. The typical gasohol blend of 10 percent fuel ethanol and 90 percent gasoline results in a 3.5 percent oxygen content, which would meet and exceed the proposed standard.

The other oxygenating fuels approved by EPA have either a methyl alcohol base or a combination of methyl alcohol and ethanol (ethyl alcohol), or are composed of an ether, such as MTBE (methyl-tertiary-butyl-ether).

According to Hollman, "our biggest problem is carbon monoxide. We're sitting here in Denver at a mile-high altitude. The air is thinner, and there's a larger fuel-to-air ratio. Denver and the cities of Colorado Springs, Greeley, and Ft. Collins all face serious air quality problems."

He says winter workdays, especially, add to the pollution.

"In the morning rush hour, auto emissions are heavy, and cold air inversions can trap air close to the ground. With the evening rush hour putting out high emission levels again, the buildup of pollutants can be quite intense."

Adding oxygenating fuels to gasoline, of course, is simply one action that can be taken to clean up the air.

Hollman says Colorado is already employing a number of other measures: inspection of vehicles to test for emission levels; increasing bus ridership; and forecasting pollution levels to advise the public when to keep driving to a minimum.

Some Basics on Ethanol Production

How does a bushel of corn kernels make its way from a farmer's field to the gasoline pump?

The process of converting corn—from its natural state as a grain "fuel" for human beings and livestock to a liquid fuel powering automobiles—depends on the same scientific principles involved in a backwoods "still."

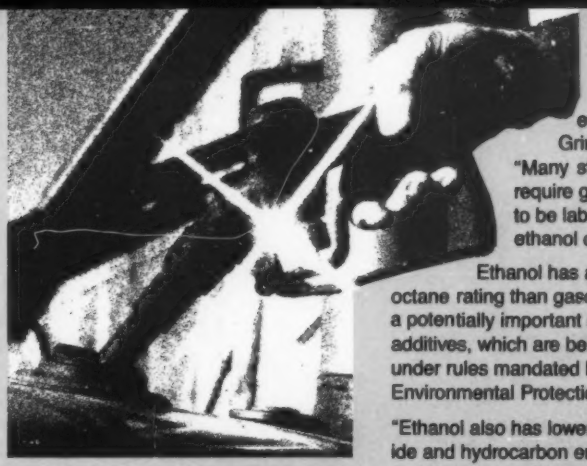
"Ethanol can be made from any feedstock containing starch or fermentable sugar," says USDA economist Gerald Grinnell. "Corn has been the principal feedstock in the United States because it is readily available, stores well (facilitating year-round ethanol production), and has been relatively inexpensive compared with other potential feedstocks."

The basics of ethanol production are the same for both dry-milling and wet-milling, the two main production processes.

In the dry-milling process, the corn is ground and then processed to convert the starch content to a sugar, which is fermented to ethanol. The resulting mixture of about 10 percent ethanol (ethyl alcohol) and 90 percent feed and fermentation products is then distilled to obtain a more concentrated ethanol solution. The "stillage," which is removed from the ethanol during distillation, contains dissolved and undissolved solids which are later removed, dried, and sold as high protein animal feed.

In the wet-milling process, the gluten (protein) surrounding the starch and corn oil is removed from the starch prior to processing and fermentation. The gluten may then be processed for sale as a high protein animal feed. Ethanol producers use the starch to make ethanol and high-fructose corn syrup, which is often used as a sweetener in soft drinks.

According to Grinnell, alcohol's use as an automotive fuel dates back to the first modern internal combustion engine, the Otto Cycle (1876), which used alcohol as well as gasoline. Henry Ford designed the Model T (1908) to use alcohol, gasoline, or any mixture of them. And, during World War II, the U.S. government operated an ethanol plant in Omaha, Nebraska,



to produce fuel for the Army, while gas stations in the Midwest sold an alcohol-gasoline blend.

"Despite this early enthusiasm, alcohol use did not continue to grow, largely because oil was plentiful and inexpensive," says Grinnell. By the 1970's, there were virtually no commercial fuel alcohol plants.

But the search for new sources of energy, sparked by two severe oil price hikes in the 1970's, had spawned more than 85 plants producing ethanol by mid-1982. In 1985, ethanol-gasoline blend sales accounted for 7.3 percent of total gasoline sales. Some 156 ethanol plants had been built by 1986, 64 of which were in operation on July 1.

"In the early 1980's, ethanol was marketed as a gasoline extender in response to calls for a domestically derived fuel that would substitute for imported petroleum," says Grinnell.

He explains that "ethanol can be burned in internal combustion engines in its pure form (neat ethanol) or blended with gasoline. Engines designed to burn gasoline require modifications to burn neat ethanol (which may contain water). Gasoline blends containing up to 20 percent anhydrous ethanol (free of water) do not require engine modifications, however."

Blends of 10 percent ethanol and 90 percent unleaded gasoline were sold as "gasohol," but the term has largely been abandoned by the industry. That's because early problems associated with the fuel, due partly to misblending in some areas, led to consumer resistance.

"Ethanol blends are now sold as 'unleaded with ethanol' or are marketed without any indication of their ethanol content," Grinnell says. "Many states, though, require gasoline pumps to be labeled to indicate ethanol content."

Ethanol has a much higher octane rating than gasoline, making it a potentially important substitute for lead additives, which are being phased out under rules mandated by the U.S. Environmental Protection Agency.

"Ethanol also has lower carbon monoxide and hydrocarbon emissions than gasoline," says Grinnell, "but more remains to be learned about ethanol's effects on the environment."

The use of ethanol does have some drawbacks—serious enough to have kept several of the larger oil companies from accepting ethanol as an octane enhancer. These companies have relied instead on producing their own petroleum-derived enhancers to satisfy octane needs.

To begin with, says Grinnell, "each gallon of ethanol contains about two-thirds as much energy (Btu or British thermal units) as does gasoline, resulting in reduced fuel economy. One should expect vehicles using gasohol to show about a 3.3-percent reduction in miles per gallon because ethanol constitutes 10 percent of the ethanol-gasoline blend."

He cites a recent report by the U.S. Department of Energy indicating that gasohol-fueled vehicles were found to have significantly more problems, including troubles with cranking, stalls while starting and in traffic, rough idling, hesitation, and loss of power.

Other, technical difficulties with ethanol have also served to limit its use mainly to independent marketers and smaller petroleum companies, which have not had the capital to modify their refineries to produce higher octane gasoline.

Among these drawbacks are volatility differences, which favor other octane enhancers; the need for special water-free storage facilities for ethanol and blends, which are water soluble; the refusal of pipelines to carry ethanol fuels because of water contamination problems; and the difficulty of uniform blending of ethanol with gasoline at some distribution points.

Helping Farmers Abroad
(continued from page 7)

Monetary Fund conditions that typically restrict imports as a prerequisite for additional credit or debt restructuring.

Yet, despite these current problems, the LDC's have the potential to be steady and, perhaps, strong growth markets for U.S. agricultural products, probably for decades to come. The diets of hundreds of millions of people are lacking in variety and nutrition, and populations in the LDC's are growing rapidly. To realize the trade potential, latent demand for food must be transformed into effective demand by raising incomes.

U.S. development assistance to projects and programs with the objective of boosting productivity and incomes can help in many of these countries. In the long run, they will be growth markets only to the extent that their economies are growing.

For the short run, the most critical issues are to enlarge trade between the LDC's and the industrialized nations, and to resolve the debt crisis.

If the LDC's cannot export more products to the industrialized world, their economies will remain depressed and they will not be able to buy increasing amounts of agricultural goods. If they have to exhaust most of their export revenues to make their debt payments, then they must reduce their imports. □

[*Written by economist Gary Vocke of the International Economics Division, Economic Research Service.*]

Wheat's Green Revolution

Perhaps more than any other U.S. commodity, it is wheat and its export markets that may seem to be threatened by increasing agricultural productivity in the less developed countries of the world.

The green revolution for wheat started in Mexico in the 1960's with the development of semi-dwarf varieties. The revolution took hold as these new varieties replaced traditional wheat varieties and as more inputs were applied to achieve their yield potential.

When grown under recommended practices, including proper irrigation and fertilization, the semi-dwarf varieties increased yields two to three times above the native varieties.

The new varieties proved to be well adapted to India, Pakistan, and Turkey, as well as Mexico. These four countries now account for almost 70 percent of the total acreage planted to semi-dwarf wheat throughout the less developed world.

The green revolution for wheat was associated with some important agricultural policy changes. Farm prices were raised, fertilizer manufacture and distribution was stepped up, and seed production was improved. Other important changes occurred, too. For example, in India, the high yields of the semi-dwarf varieties financed wells to shift additional land into irrigated wheat production. As land was shifted from rain-fed crops (such as coarse grains, oilseeds, and pulses) to irrigated wheat production, India became the world's largest importer of edible oils.

With improving management, wheat output will probably continue to increase in these four countries, but they are not expected to become competitors for U.S. wheat exports. They have modified their policies to avoid creating subsidized surpluses that would be exported at a loss.

At the same time, wheat imports are increasing rapidly in the tropical regions of the world where the crop does not grow well. Because of their high temperatures and disease problems, it is unlikely that these countries will ever produce wheat on a large scale.

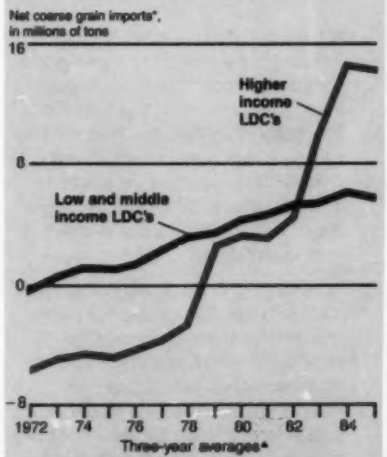
A Plus for Coarse Grains

It's a familiar pattern that has been repeated in one country after another. As incomes rise, consumers eat more meat and poultry products.

This dietary shift—arising from higher disposable incomes, urbanization, and changing lifestyles—is increasing the requirements for animal feedstuffs much faster than the LDC's can produce their own feed. The resulting shortfalls are creating strong, growing markets for coarse grains.

But this pattern, it must be remembered, is closely correlated with income levels. For the low-income and middle-income LDC's, per capita feed use of coarse grains has remained relatively flat. The higher income LDC's, by contrast, have been the driving force over the last decade in shifting the developing world from its position as a net exporter of coarse grains to a net importer.

The Higher Income LDC's Led the Shift from Net Coarse Grain Exporters to Net Importers



*Net imports equal imports minus exports. Negative numbers indicate that exports exceeded imports. ▲Plotting data are 3-year averages centered on the year shown.

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1986 Agricultural Chartbook. *(Published November 1986; 119 pages; GPO Stock No. 001-019-00488-6; $5.50.)*

Rice's Domestic Markets

Not all the rice grown on American farms is destined for export. In the last few years, a third or more of the total U.S. supply has gone to the fast-growing domestic market.

A recent report by economist Shelby Holder provides the sole source of detailed information on domestic distribution patterns for U.S. rice. It is based on results of a survey covering the 1984/85 marketing year.

The survey found that rice millers and repackagers distributed 33.7 million cwt of rice to the three major domestic outlets in 1984/85, up from 21.2 million cwt 10 years earlier. These three principal outlets are direct food use of rice, use in beer, and use in processed foods.

The largest outlet—direct food use—represents rice to be sold through food stores or rice going to restaurants or similar establishments. This outlet took nearly 22 million cwt of rice, up from 12.6 million cwt in 1974/75.

Milled white rice accounted for 77 percent of the reported shipments for direct food use, parboiled rice for 17 percent, precooked rice for 4 percent, and brown rice for 1 percent. Other specialty rices, primarily aromatic rice, accounted for less than 1 percent.

To replace some of the nutritive value lost by removing the bran layer in the milling process, 79 percent of direct food use shipments were treated with thiamin, niacin, and iron enrichments.

The second largest domestic outlet, beer brewing, accounted for about 25 percent of total domestic rice use. Rice use for beer has held fairly stable in the early 1980's.

Breakfast cereals still dominate the third largest domestic outlet—processed foods (excluding beer). Cereals accounted for 3.6 million cwt of rice shipped in 1984/85 out of a total of around 5 million cwt going into processed foods. Medium-grain rice is the most common type used by breakfast cereal manufacturers.

Soups and baby foods continued as relatively minor uses for rice, although their combined shipments were equivalent to 556,000 cwt in 1984/85. All of the rice used in soups was long grain. Baby food processors used brokens and rice flour.

U.S. Rice Distribution Patterns, 1984/85 *by Shelby Holder, Jr. (Published December 1986; 27 pages of text and data tables; GPO Stock No. 001-019-00481-9; $1.75.*

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